From the Southern Association for Vascular Surgery

Carotid-subclavian bypass grafting with polytetrafluoroethylene grafts for symptomatic subclavian artery stenosis or occlusion: A 20-year experience

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Background and Purpose: Since the advent of subclavian artery percutaneous transluminal angioplasty/stenting, several authorities advocate it as the treatment of choice for patients with subclavian artery disease, claiming results equal to or better than those of reconstructive vascular surgery. However, most of their quoted surgical series included patients who may have other brachiocephalic disease who were treated nonuniformly by means of various bypass grafts with different grafts in the same series (eg, Dacron, polytetrafluoroethylene [PTFE], or vein). In this study, we analyze the long-term results of a large series of carotid-subclavian bypass grafts for subclavian artery disease in which PTFE was uniformly used; the study can be used as a future reference to compare the results of subclavian artery percutaneous transluminal angioplasty/stenting.

Patient Population and Methods: Fifty-one patients with symptomatic subclavian artery disease (40 occlusions and 11 stenoses) who were treated with carotid-subclavian bypass grafts (PTFE [Goretex]) during a 20-year period were analyzed. Graft patency was determined clinically and confirmed with Doppler scanning pressures and duplex ultrasound scanning. The cumulative patency, overall survival, and symptom-free survival rates were calculated with the life table method.

Results: Indications for surgery were arm ischemia in 34 patients (67%), vertebrobasilar insufficiency (VBI) in 27 (53%), and symptomatic subclavian steal in 7 (14%). A combination of arm ischemia and VBI occurred in 17 (33%) of these patients. The mean follow-up was 7.7 years with a median of 7.0 years (range, 1-19 years). The 30-day morbidity rate was 6%, with no perioperative stroke or mortality. Immediate relief of symptoms was achieved in 100% of patients; however, four patients (8%) had late recurrent symptoms (three with VBI). The primary patency and secondary patency rates at 1, 3, 5, and 10 years were 100%, 98%, 96%, and 92% and 100%, 98%, 98%, and 95%, respectively. The symptom-free survival rates at 1, 3, 5, and 10 years were 100%, 96%, 82%, and 47%, respectively. The overall survival rates at 1, 3, 5, and 10 years were 100%, 98%, 86%, and 57%. The mean hospital stay was 3.5 days in the late 70s and 80s and 2.1 days in the 90s ($P < .001$).

Conclusions: Carotid-subclavian bypass grafts with PTFE grafts for subclavian artery disease are safe, effective, and durable and should remain the procedure of choice, particularly in good-risk patients. (J Vasc Surg 2000;32:411-9.)

Atherosclerotic disease of the subclavian artery can be asymptomatic or may produce various combinations of symptoms related to posterior cerebral ischemia or upper extremity ischemia. Intervention may be indicated when such symptoms occur.

Management of subclavian artery occlusive disease

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Competition of interest: nil.

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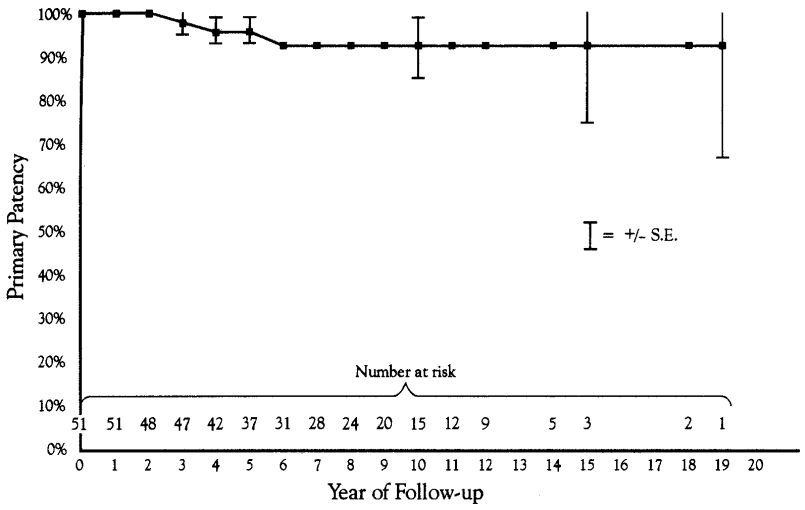

Fig 1. Kaplan-Meier graph showing time to loss of primary patency.

has evolved a great deal over the years, and a variety of therapeutic options are available. Debakey et al[1] first reported successful revascularization of innominate and subclavian arteries via a transthoracic approach in 1958. Diethrich et al[2] subsequently introduced the carotid-subclavian bypass graft in 1967 as the first extrathoracic approach. Several studies have shown that the durability and efficacy of this technique and the carotid-subclavian transposition are comparable to the transthoracic approach with much less operative mortality and morbidity.[3-9]

Percutaneous transluminal angioplasty (PTA) with or without stenting of the subclavian artery provides another tool for those treating patients who have stenosis or occlusion. The first reported case of subclavian artery angioplasty was by Bachman and Kim[10] in 1980. Subclavian artery PTA/stenting is now commonly used by some for treating subclavian artery stenosis, and certain authorities advocate it as the first line of therapy or treatment of choice for this disease.[11-16] In this study, we analyze the largest long-term series of carotid-subclavian bypass grafts for subclavian artery stenosis or occlusion in which polytetrafluoroethylene (PTFE) was uniformly used in North America; this can be used for future reference to compare the results of subclavian artery PTA/stenting.

PATIENT POPULATION AND METHODS

One hundred nine patients underwent carotid-subclavian bypass grafts in which PTFE grafts were used (Goretex; W. L. Gore and Associates, Inc, Flagstaff, Ariz) between July 1978 and June 1998 (20 years) for both symptomatic subclavian artery disease and common carotid artery disease. In this study, we analyze 51 of these patients with isolated symptomatic subclavian artery disease. Patients with innominate lesions or combined carotid and subclavian artery disease or patients who may need complex reconstruction were excluded. All patients had a patent and normal vertebral artery at the side of the subclavian artery disease, and 22 of 27 patients with vertebrobasilar insufficiency (VBI) had hypoplastic or diseased contralateral vertebral arteries that were not suitable for vertebral artery reconstruction.

The hospital records were reviewed to determine the demographic data, risk factors, presenting clinical manifestation, the location of the subclavian artery stenosis or occlusion, and immediate postoperative results. Indications for surgery were classified into arm ischemia (claudication, rest pain, or trophic changes), symptomatic subclavian steal, or VBI (including dizziness, drop attacks, blackout spells, blurred vision, diplopia, ataxia, and vertigo). All patients with VBI had at least two or more of these symptoms; therefore, no patients had surgery for the isolated symptom of dizziness. Patients with VBI or symptomatic subclavian steal were also evaluated for operation by neurologists to rule out other causes of their symptoms. Patients with subclavian steal gave a classic history of VBI on arm exertion and had retrograde vertebral flow documented with duplex ultrasound scanning and angiography. All patients had preoperative arm Doppler scanning pressures with pressure gradient measurements. They also had four-

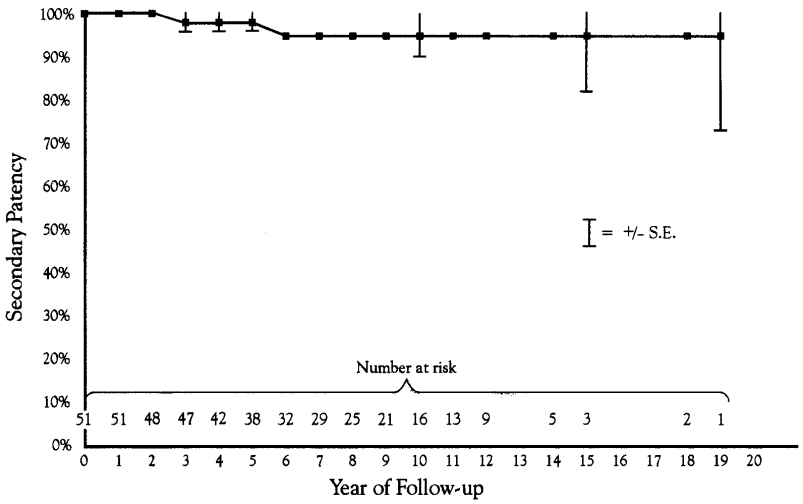

Fig 2. Kaplan-Meier graph showing time to loss of secondary patency.

Table I. Demographic data

Demographic	*No.*	*Percentage*
Sex (male)	29/51	57%
Smoking	38/51	75%
Diabetes mellitus	14/51	28%
Hypertension	26/51	51%
Hypercholesterolemia	14/51	28%
Coronary artery disease	21/51	41%
Subclavian artery occlusion	40/51	78%
Subclavian artery stenosis	11/51	22%
Left side	44/51	86%
Right side	7/51	14%
Mean age (y)	62 (range, 46-75)	
Mean preoperative pressure gradient (mm Hg)	35 (range, 25-52)	
Mean postoperative pressure gradient (mm Hg)	4.92 (range, –5 to 10)	
Mean follow-up (y)	7.7 (range, 1-19)	

vessel arch aortography with carotid and subclavian arteriography before surgery. All operations were performed while the patients were under general anesthesia, and 6- or 8-mm PTFE grafts were used.

Follow-up information was obtained from direct office evaluation and the vascular laboratory data. Graft patency was determined by the presence or absence of peripheral arterial pulses and confirmed by the segmental arm Doppler scanning pressures and duplex ultrasound scan examinations that were done every 6 to 12 months. All patients with recurrent symptoms underwent a duplex ultrasound scan and angiography at the time of the symptoms' recurrence. The cumulative patency rates, overall survival rates, symptom-free survival rates, and rates of freedom from symptom recurrence were calculated with the life table method.

RESULTS

The mean follow-up in this series was 7.7 years (range, 1-19 years). Table I summarizes the demographic data. Forty patients had subclavian artery occlusion (78%), and 11 had stenoses (22%). Forty-four lesions were located on the left side (86%), and seven were located on the right side (14%). Table II summarizes the indications for surgery with arm ischemia present in 34 (67%) of 51 patients, VBI in 27 (53%), and symptomatic subclavian steal in 7 (14%). As shown in this table, one indication for surgery was present in 34 (67%) of 51 patients, and two indications were present in 17 (33%) of 51 patients.

Early (30-day) results. The 30-day morbidity rate was 6% (3 of 51), with no perioperative stroke or

Table II. Indications for surgery

	No.	*Percentage*
Indication		
Arm ischemia	34	67%
VBI	27	53%
Symptomatic subclavian steal	7	14%
No. of indications for surgery		
One of three indications	34	67%
Two of three indications	17	33%

Table III. Number of days of hospitalization

No. of days in hospital	*No. of patients*	*Percentage*
1	4	8%
2	10	20%
3	24	47%
4	11	21%
5	2	4%

mortality. Three patients had early perioperative complications, which included one postoperative myocardial infarction. Two patients had phrenic nerve palsy; both recovered within 3 to 6 months. Immediate relief of symptoms was achieved in 100% of patients, with an early graft success (30-day patency) of 100%. The mean preoperative arm pressure gradient was 35.2 mm Hg with a mean postoperative pressure gradient of 4.9 mm Hg.

Table III summarizes the number of days of hospitalization. As noted, 8% of patients had 1 day and, 20% had 2 days of hospitalization. Most of the patients who had surgery in the 1990s (14 of 20) had no more than 2 days of hospitalization. The mean hospital stay was 3.5 days in the late 1970s and 1980s (July 1978 to December 1989) and only 2.1 days in the 1990s (January 1990 to June 1998; $P < .001$).

Late results. As indicated earlier, immediate relief of symptoms was achieved in 100% of patients; however, four patients (8%) had late recurrent symptoms. The preoperative indication for surgery in three of these four patients was VBI with symptom recurrence at 3, 5, and 9 years, and all had patent grafts. The fourth patient had surgery for arm ischemia with recurrence of symptoms and graft failure at 6 years. This patient refused further surgery.

Overall, 48 of 51 grafts stayed patent (primary patency), one underwent a thrombectomy (secondary patency), and two failed (one patient refused surgery and the other patient's graft was revised to carotid-axillary artery bypass graft). The two patients whose grafts were revised were asymptomatic at the time of the vascular consult; however, both gave a history of coolness and tingling of the hand and forearm that lasted for only 1 to 2 hours at the time of their presentation to their primary care physician. Their vascular workup showed thrombosed grafts. After discussing their options, they chose to undergo thrombectomy because of their fear of recurrent symptoms. One had a successful thrombectomy, and the other had a thrombectomy and revision of the carotid-subclavian bypass graft to carotid-axillary bypass graft because of significant stenosis at the subclavian site. Figs 1 and 2 show the primary and secondary patency rates by means of the Kaplan-Meier life table method. As noted, the primary patency and secondary patency rates at 1, 3, 5, and 10 years were 100%, 98%, 96%, and 92% and 100%, 98%, 98%, and 95%, respectively. Fig 3 shows the symptom-free survival rates, which were 100%, 96%, 82%, and 47%, at 1, 3, 5, and 10 years, respectively. Fig 4 shows the overall survival rates, which were 100%, 98%, 86%, and 57% at 1, 3, 5, and 10 years, respectively. Overall, 22 patients died by the end of the follow-up: 13 (59%) died as a result of myocardial infarction, 6 (27%) of malignancy, 1 (5%) of stroke, 1 (5%) of pneumonia, and 1 of an unknown cause. Fig 5 shows the time to symptom recurrence. As noted, the rates of freedom from symptom recurrence at 1, 3, 5, and 10 years were 100%, 98%, 95%, and 88%, respectively.

DISCUSSION

Although symptomatic subclavian artery disease is relatively uncommon,[8,9,17-19] it may represent a significant disability and should be treated appropriately to provide good and long-lasting results. The procedure should be effective and durable with minimal complications.

Currently, extrathoracic revascularization (carotid-subclavian bypass graft, subclavian-carotid transposition, axillary-to-axillary artery bypass graft) and percutaneous balloon angioplasty with or without stenting have been advocated as the primary treatments for symptomatic subclavian artery stenosis or occlusion. However, most studies in which angioplasty results are reported have indicated that the treatment of stenoses yields results that are significantly different from the treatment of occlusions.[11]

It is generally thought that carotid-subclavian bypass graft and carotid-subclavian transposition have emerged as the treatments of choice for symptomatic proximal subclavian artery stenosis or occlu-

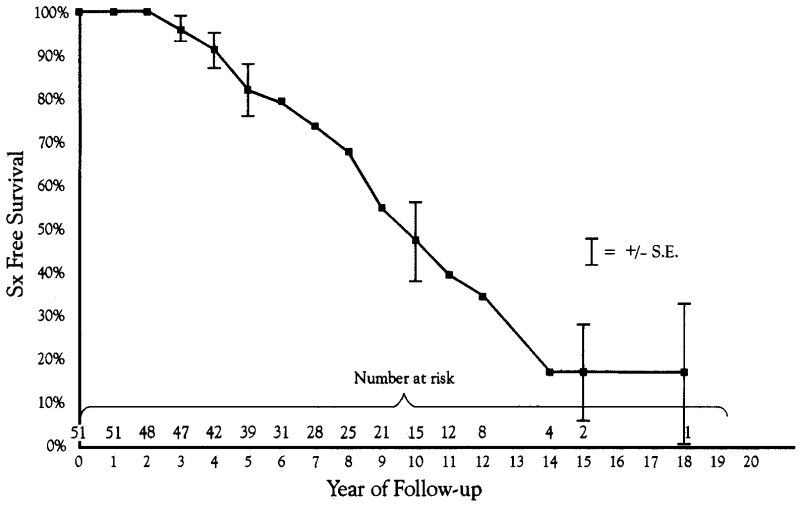

Fig 3. Kaplan-Meier graph showing symptom-free survival.

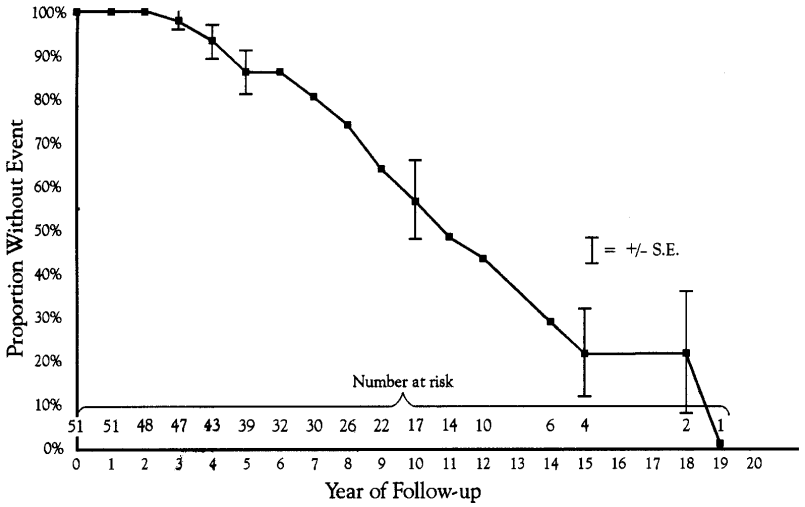

Fig 4. Kaplan-Meier graph showing overall survival rates.

sion.[4,8,19-21] Most modern series in which the use of the extrathoracic approach in symptomatic subclavian artery disease is reported demonstrated durable relief of symptoms, with mortality rates of 0% to 3% and perioperative stroke rates of 0% to 5%.[20] However, most of the literature has included patients who may have had symptomatic brachiocephalic disease or carotid artery disease apart from the subclavian artery stenosis or occlusion. These patients were also treated nonuniformly with various types of bypass grafts with the use of different grafts in the same series.[3-9,20-23] This is significant because it is difficult to compare the effectiveness of carotid-subclavian bypass graft with other alternative techniques (PTA / stenting) when there is nonuniformity in the type of procedure and conduit. Furthermore, graft material appears to affect long-term patency. Several studies have shown saphenous vein grafts to perform inferiorly to prosthetic grafts in this location. Ziomek et al[6] showed a 5-year patency of 94% for prosthetic grafts compared with 58% for vein grafts in patients with carotid-subclavian bypass graft. Some authorities have documented that ringed PTFE is superior to Dacron or vein in terms of durability.[20,21] Law et al[20] reported that of all the different conduits used for carotid-subclavian bypass

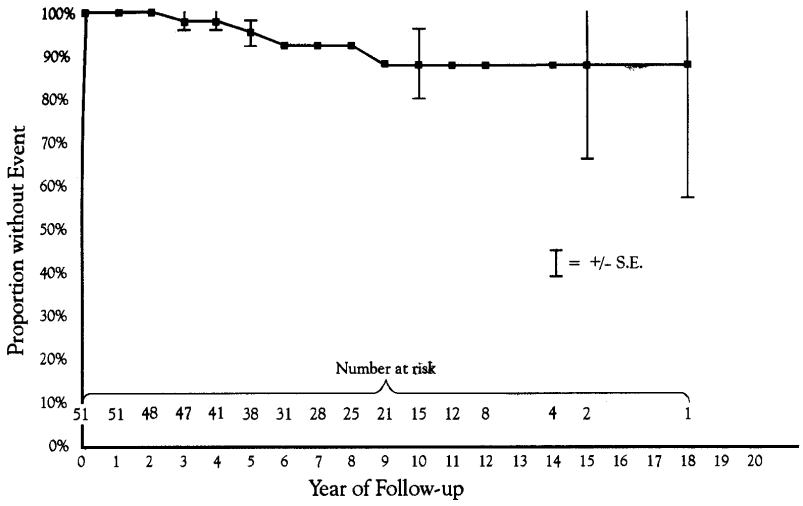

Fig 5. Kaplan-Meier graph showing the time to symptom recurrence.

grafts, PTFE demonstrated the best results with a 5-year actuarial patency of 95.2% ± 4.6%, followed by Dacron grafts at 83.9% ± 10.5%. Saphenous vein grafts had the poorest long-term patency rate at 64.8% ± 16.5%. However, the differences were not statistically significant, which was thought to be because of the small sample size. Because of this nonuniformity, we analyzed carotid-subclavian bypass graft for the treatment of symptomatic subclavian artery stenosis or occlusion using only PTFE as the conduit.

The advent of PTA/stenting has created increased enthusiasm and interest in treating subclavian artery stenosis or occlusion with the use of this percutaneous approach. This technique has been advocated by some as the first line of therapy or the treatment of choice for subclavian artery stenosis or occlusion.[11-16] They claim lower morbidity and mortality and a shorter hospital stay, with a high success rate. Our study takes strong issue with this claim. Our results confirm that carotid-subclavian bypass grafting with the use of PTFE grafts is safe, effective, and durable.

In regard to safety, our 30-day morbidity rate was 6% with no perioperative strokes or mortality. In a recent study of stenting for atherosclerotic occlusive disease of the subclavian artery, Rodriquez-Lopez et al[13] documented an 11% minor complication rate and a 4% major complication rate that included subclavian artery dissection, axillary artery thrombosis, and brachial artery thrombosis. One patient had transient ischemic attacks the day of the procedure. Millaire et al[15] reported on their immediate and late results in 50 patients who underwent subclavian angioplasty. Angioplasty was successful in 90% of their patients. However, three (6%) cases of thrombosis occurred because of the percutaneous approach: one of the axillary artery, one of the brachial artery, and one of the aorta, which required an aortobifemoral bypass graft. In addition, complications occurred in two other (4%) unsuccessful angioplasties: an ischemic stroke in one case and a thrombosis of the dilated side, which required a surgical bypass graft. This is a combined major perioperative complication rate of 10%.

In another recent study, Henry et al[11] reported that 103 (91%) of 113 lesions were successfully treated with PTA; however, ten (53%) occlusions could not be recanalized. Fifty-one stents were implanted in 46 patients in this group. There were three (3%) procedure complications: one transient ischemic attack, one major fatal stroke, and one arterial thrombosis (a 1% major stroke and death rate). They also cited two hematomas at the femoral puncture site without any significant consequences plus an additional brachial thrombosis that required surgical treatment (3% minor complication rate), with a combined minor and major complication rate of 5%.

We also evaluated the efficacy of carotid-subclavian bypass grafting with PTFE for symptomatic subclavian artery stenosis or occlusion. Immediate relief of symptoms was achieved in 100%, with 100% early (30-day) graft patency. However, four patients had late recurrent symptoms, three of whom presented with VBI; all had patent grafts. The VBI symptoms in one of these three patients was thought to result from

cardiac arrhythmias and to result from intracranial small vessel disease in another patient. Initial technical success rates in studies in which PTA / stenting was used for subclavian artery stenosis or occlusion range from 92% to 100%.[11-13,24-26] Some of the failures that occurred early on in these studies involved the inability to cross total occlusions with a guidewire.[24,26] Several other studies indicate that subclavian occlusions were recanalized in only about half of the cases.[11,12,27-29] Seventy-eight percent of our patients had subclavian artery occlusion instead of stenosis.

Durability is another important issue that was addressed in our study. The primary and secondary patency rates at 1, 3, 5, and 10 years were 100%, 98%, 96%, and 92% and 100%, 98%, 98%, and 95%, respectively.

Long-term follow-up in patients who underwent PTA and stenting for subclavian artery stenosis or occlusion is limited in most reported series. The reported primary patency rates in these patients range from 73% to 87% at 4 years with secondary patency rates ranging from 90% to 94%.[11,13,14,24]

Currently, there are no prospective randomized data comparing angioplasty / stenting of the subclavian artery with surgical bypass grafting in the treatment of subclavian artery disease. However, in a study by Farina et al,[29] 21 patients who underwent PTA for proximal stenosis of the subclavian artery were compared with 15 patients who underwent carotid-subclavian reconstruction. The incidence of procedural complications was similar. Although better early results were achieved in patients who underwent PTA (actuarial patency: PTA 91%, surgery 87%) after dilatation, Farina et al observed a continuous deterioration of the hemodynamic status of the artery, which resulted from a high rate of late restenosis (actuarial patency: PTA 54%, surgery 87%). It should be noted that they excluded patients from this study with long stenoses (> 4 cm) and those with complete occlusion of the subclavian artery, which can easily be corrected surgically.

In an era of managed care, greater emphasis has been placed on cost-effective treatment. Some authorities cite financial advantages of PTA / stenting over surgery with respect to length of hospital stay. However, this may be balanced by the number of restenosed subclavian arteries after PTA / stenting that require another dilatation, hospital stay, or both. Furthermore, our data show that in the 1990s, patients treated with carotid-subclavian bypass grafting had an average hospital stay of only 2.1 days with several patients being discharged within 24 hours postoperatively.

In conclusion, our experience with carotid-subclavian bypass grafting for subclavian artery stenosis or occlusion with PTFE grafts has shown it to be very safe and effective, with excellent long-term patency. It provided our patients with lasting relief from their symptoms, and we think it is still the treatment of choice for subclavian artery stenosis or occlusion in good risk patients.

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Life table data are available on the web.

DISCUSSION

Dr William H. Edwards, Sr (Nashville, Tenn). Dr Snyder, Dr Seeger, members, and guests. I appreciate the opportunity of being able to discuss Dr AbuRahma's paper, and I certainly appreciate his timely fashion of sending it to me in order for my review.

He has undertaken a comparison of carotid subclavian bypass grafts to angioplasty and stenting for subclavian occlusive disease. Subclavian occlusive disease is rarely a life-threatening condition and represents a small percentage of patients presenting with cerebrovascular insufficiency. In our practice it was approximately 6% of patients evaluated for cerebral symptoms. This means few vascular surgeons have the opportunity to see many of these patients and may see even fewer as PTA and stenting increases.

I will direct my remarks to the two issues presented by Dr AbuRahma: bypass surgical operations for subclavian occlusive disease and angioplasty.

My early vascular training was at UCLA with Jack Cannon and Wiley Barker, and I was introduced to endarterectomy in the treatment of vascular lesions. When I went to Houston, I worked with Dr DeBakey, and I was introduced to the use of Dacron grafts for reconstruction of occlusive disease. In 1957 when Dr Scott and Dr Cate did the first combined subclavian and vertebral artery for endarterectomy at Vanderbilt, I was present at that operation.

Early in my practice I used endarterectomy much more frequently than intrathoracic bypass for proximal subclavian occlusive lesions. Neither of these operations, however, was much fun. I was not innovative enough to realize that the ipsilateral carotid artery was begging to be used to correct subclavian stenosis. Stanley Crawford did that for us in the mid 1960s, improving the playing field.

Dr AbuRahma has documented the demographics, symptoms, and early and late results for his 51 patients treated over a 20-year period at the Byrd Health Sciences Center. It is, he believes, the largest carotid subclavian bypass with the longest follow-up reported in North America. This means we can compare these results with the largest series of subclavian carotid transpositions with the longest follow-up recorded: our series of 178 patients reported 4 years ago with 25-year follow-up. When compared with other series of extrathoracic bypass graft for subclavian stenosis, Dr AbuRahma's PTFE series has better short- and long-term patencies than those series that use Dacron, autogenous tissue, and/or PTFE. A major advantage of transposition is the absence of any prosthetic material. This overcomes the problems he described in the paper as nonuniformity in the type of procedure and conduit. The mortality in his series was 0% while ours was 1.1%. We had one death from an arrhythmia, and we had one death from septicemia from an infection that was not adequately treated early on. The short- and mid-term patencies in both transposition and bypass were 100%. Dr AbuRahma's series had three occlusions with patency restored by thrombectomy in one and bypass in a second. The transposition series had one occlusion during the 25-year follow-up because of occlusion from a lesion of the proximal internal common carotid artery. A review of the literature at the time of the publication of our transposition series yielded only two additional reported failures in 453 cases of transposition, a truly remarkable long-term patency rate.

Lesions of the proximal subclavian artery are amenable to treatment with PTA and stenting. There is no question about that. The question is, can the procedures give results that are comparable to bypass or transposition? Many series have been reported, as Dr AbuRahma reported to us, with good short-term patencies and morbidities from 10% to 20%. In a combined series of 423 PTAs for subclavian innominate disease, there was a technical success rate in 92% and a recurrence rate of 19% at 5 years. One of the complications reported more than once and discussed here with the panel yesterday was rupture of the subclavian artery. There is no question that the surgeon who has ever handled a subclavian artery knows that it is a thin, delicate artery that can be torn with minimal manipulation. With that said, however, with a leap of faith and knowing as a vascular surgeon that you can handle any subclavian artery, transposition becomes a very nice operation. There are no controlled or randomized series to compare PTA and surgical intervention. Surgical correction is safe with low morbidity and mortality rates approaching 0% and excellent patencies with long-term relief of symptoms.

As endovascular surgical techniques in the treatment of atherosclerotic disease and other arteries have improved with the advances in technology, ease of access, improved results, and better understanding of the pathophysiology of the disease, so will PTA and stenting occur in subclavian occlusive disease. Everyone performing vascular surgery must be sure that they have the skills and the credentials to offer PTA and stenting for those patients in whom it might be appropriate.

Dr AbuRahma has reported an excellent, well-documented series of carotid subclavian bypass for symptomatic subclavian occlusive disease with long-term follow-up and excellent results. I do not, however, agree with his conclusion that it is the surgical operation of choice for proximal subclavian lesion. Transposition of the subclavian to the ipsilateral carotid gives somewhat better long-term results, restores flow directly into the vertebral artery in those patients with hindbrain symptoms, requires only one suture line, removes completely the risk of embolic ischemia, and, lastly, does not introduce a prosthetic into the neck. I do agree that currently, PTA is not the procedure to recommend to most patients.

I have three questions for Dr AbuRahma. Since 34 of your patients had arm ischemia, does it bother you that you are leaving the potential source of emboli with a bypass? By the same token, 27 patients had hindbrain symptoms. Were these all due to complete subclavian occlusions with retrograde vertebral flow, or were they lesions in the proximal vertebral artery? Second, at what point on the distal subclavian do you perform the distal anastomosis? And lastly, what technique do you recommend in the patient who has significant ipsilateral internal carotid occlusive disease?

I enjoyed the presentation and congratulate the authors on their paper. Thank you.

Dr Ali F. AbuRahma. Thank you, Dr Edwards, for your nice comments and questions. It was not the purpose of this paper to compare carotid subclavian bypass with carotid transposition. There is no doubt that carotid transposition is a good procedure to do, but most of the quoted series in the radiology or cardiology literature use the term *carotid subclavian bypass* to compare PTA series. What I am trying to say in this article is let's have a uniform series using whatever you want (PTFE, Dacron, etc) and compare these results with PTA and stenting for both safety and durability. I agree with Dr Edwards: carotid transposition in good hands is perhaps even better than carotid subclavian using PTFE or Dacron.

In terms of the patients with arm ischemia, if there was any question, we felt it was embolic. These had suture ligation proximal to the graft, and that was done in several of our patients.

In regard to the presence of internal carotid artery stenosis, you will notice that this is a very uniform series because we did not include these patients in the series, but we have done close to probably two dozen of these over the last 20 years, where we combined a carotid endarterectomy with carotid-subclavian bypass.

Dr Timothy Sullivan (Greenville, SC). Dr AbuRahma, I very much enjoyed your paper. We reported in the *Journal of Vascular Surgery* in 1998 on over 80 brachiocephalic interventions with angioplasty and primary stenting. Our results indicated a patency rate of 84% at 4 years including initial failures, those failures occurring with complete occlusions of the subclavian artery. I would echo your statement that as with most endovascular procedures, including brachiocephalic interventions, the aortoiliac segment, and lower extremity interventions, surgical repair remains the gold standard and is typically the treatment of choice.

I have a question regarding patients with subclavian stenosis and coronary steal syndrome. In our series, the most common indication for intervention was in patients with internal mammary steal, in patients who had had coronary bypass typically to the LAD from the left internal mammary artery. Many of those patients actually presented with unstable coronary syndromes, and we felt that angioplasty and stenting was a very reasonable alternative in those patients (perhaps carried a lower morbidity and mortality) and that it really did not burn any bridges—that at a later date we could go ahead and perform a surgical reconstruction. I would like to know if any of your patients in your series presented with coronary steal syndrome and what your thoughts are regarding that.

Dr AbuRahma. Thank you for your question. None of the patients in this series had coronary steal, but I agree with you that someone with coronary steal and proximal lesion can be treated with PTA and stenting. As I indicated earlier, and I am emphasizing one more time, I am not saying that PTA and stenting is not an option.